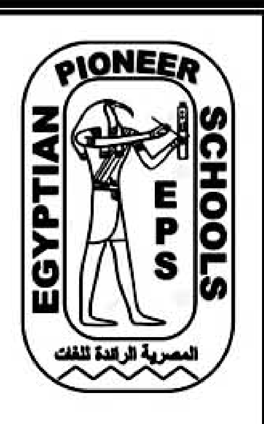
Egyptian Pioneer Schools Language



THINK AND LEARN



Prep. 2 Science Booklet

2018 - 2019

First Term

Unit 1: Periodicity of elements and their properties

Lesson 1 : Attempts of elements classification

- The classification of the elements aims to be easily studied and to find the relation between elements and their physical and chemical prosperities.

Classification trails of elements :

Mendeleev's Periodic table

Moseley's periodic table

Modern periodic table

① Mendeleev's periodic table :

- The known elements till this time were 67 elements.
- He arranged the elements according to their atomic weights from left to right in horizontal rows (called periods later).
- The elements properties are periodically repeated at the beginning of each new row (period).

Advantages of Mendleev's table:

- He left empty spaces because he predicted the ability of discovering new elements.
- He corrected the wrong estimated atomic weights of some elements.

Defects in Mendeleev's table :

- He had to make a disturbance in the ascending order of atomic weights for some elements to put them in groups with the same properties.
- **Isotopes :** elements which have many forms with the same atomic number but with different atomic weights . He had to deal with the isotopes as different element (as he classified the elements according to the atomic weight).

A scientist called Rutherford (from Newzeland) discovered that the nucleus contain positively charged protons.

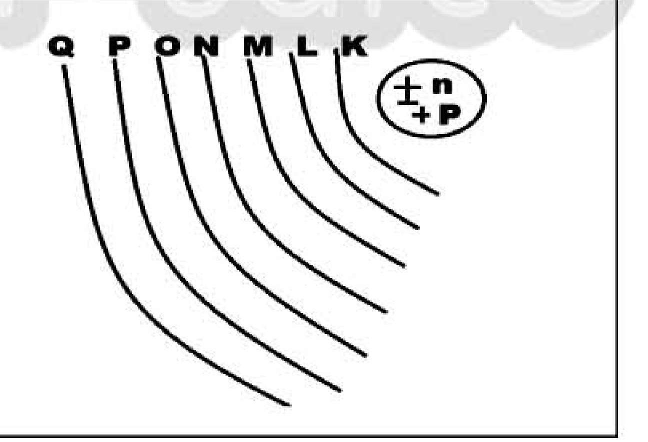
② Moseley's periodic table :

After studying the properties by X-ray he discovered that:

- The periodicity of the elements is related to their atomic numbers not the atomic weights.
- He re-arranged the elements in an ascending order according to their atomic numbers (that means each element increases by one than the previous element.)
- He added the inert gases in (0)group
- He classified each group into two sup-groups (A,B) as he found differences between their properties.
- He located a place below his table for two groups : Lanthanides and actinides.

③Modern periodic table:

- Bohr discovered that there are 7 main energy levels (in the heaviest atom so far) and each one consists of number of energy sub-levels
- The classification of elements in the modern periodic table is according to the atomic number and the way to fill the energy sub-levels with electrons.



Description of the modern periodic table:

❶ The number of known elements till now are 118 elements ; 92 of them are found naturally in the earth's crust and the remaining are prepared artificially.

❷ The periodic table is formed of 16 vertical groups and 7 horizontal periods.

❸ Elements of (A) groups are found in the left and the right sides of the table, while elements of groups (B) are found in the middle of the table.

❹ To ease the table studying, it is formed of 4 blocks:

a) **S-block** : located in the left side of the table, contain 2 groups

Group (1A) which is called the alkali metals

Group (2A) which is called alkali earth's metals

b) **P-block :** located in the right of the table and formed of 6 groups, from group (3A) to group (7A) and the (0) group.

7A: The halogens group (F , Cl , Br , I , At)

0 group: the inert or nobel gases (He , Ne , Ar , Kr , Xe , Rn).

c) **D-block :** located in the middle of the table and formed of 8 groups (8B group is formed of 3 columns). They are called the transitional elements.

d) **F-block :** they are found below the table and formed of 2 groups (lanthanides and actinides).

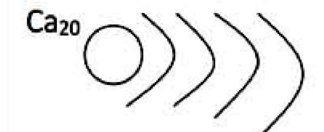
*Determination of the position of the elements in the periodic table by knowing the atomic number :

1- To know the atomic number of the element

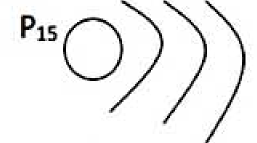
Ex: Ca_{20} , P_{15} , Ne_{10} , H_1

2- To make electronic configuration.

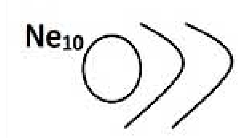
Ca_{20}

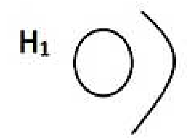


P_{15}





Ne_{10}


H_1


3-The number of energy levels is equal to the number of periods

Ex: Ca_{20} → period 4

P_{15} → period 3

Ne_{10} → period 2

H_1 → period 1

4- The number of electrons in the outermost energy levels is equal to the number of the group.

Ex: Ca_{20} → (2A)

P_{15} → (5A)

Ne_{10} → (0) group (8A)

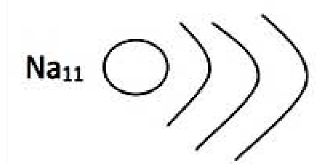
H1 → (1A)

<u>More examples:</u>

He_2 period 1 , group 2

Li_3 period 2 , group 1

K_{19} period 4, group 1

Na11  period 3 , group 1

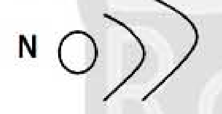
***Determination of the atomic number of the element by knowing its position in the table :**

1-determine the exact position of the element in the table , the number of period and group.

	5A	6A	7A	(0)
2nd group	N	O	F	Ne
3rd group	P	S	Cl	Ar

2- Write the number of the energy levels of the element which is represented by the number of the periods.

Ex:

N 

P 

O 

S 

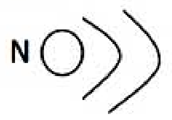
F 

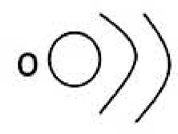
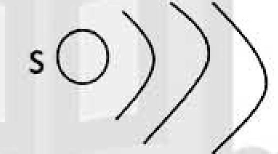
CL

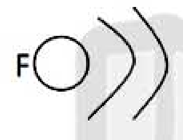
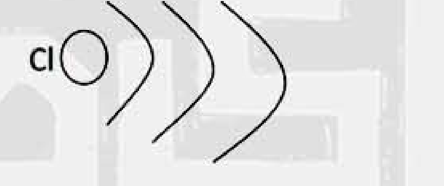
Ne  Ar

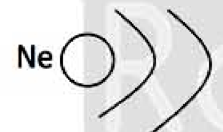
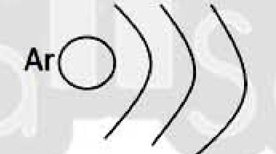
3- Fill the outermost energy level with electrons which represented by the number of the group (concerning that 0 group ended with 8 electrons in the outermost shell)

Ex:

N  P 

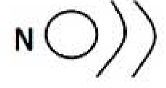
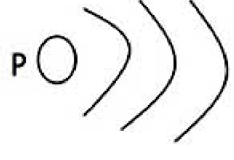
O  S 

F  Cl 

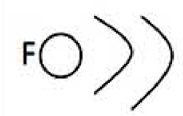
Ne  Ar 

4- Complete the other energy levels with the maximum number of electrons they can contain.

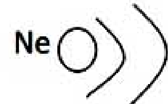
Ex:

N  P 

O  S 









5- Calculate the atomic number of the element.

6- Put the number of the positive protons inside the nucleus which is equal to the number of negative electrons.

*The atomic number of the element equal to the sum of number of electrons rotating around the nucleus and also equal to the number of protons

Atomic number = no. of electrons = no. of protons

Quiz ①:

Q (1): Choose :

1- The number of known elements is ……………………… .

(216 - 116 - 316 - 16)

2- The number of negative electrons in the atom in its normal state equals……………………… .

- Number of protons
- Twice the number of protons
- Number of neutrons
- Half the number of neutrons

3- The atomic number of the element equal ……………………… .

- The sum of the neutrons number in the nucleus
- Sum of the number of electrons rotating around the nucleus
- The number of protons inside the nucleus
- Both the last 2 answers

4- In the periodic table , the elements which are identical in the properties lie in the same……………………… .

(period - group - nucleus - energy level)

5- The scientist who left a vacancies in his table to be filled with suitable discovered elements in the future is ……………………… .

(Moseley - Bohr - Newlander - Mendeleev)

6- The elements which occupy the middle block (d) in the modern periodic table is ………………… Elements.

(Alkali - Alkali earth - transitional - Inert)

7- The scientist which discovered the main energy levels is ………………… .

(Mendeleev - Bohr - Moseley - Rutherford)



8- The element with atomic number (17) is similar in its chemical construction to the element of atomic number

(2 - 7 - 9 - 19)

9- The element with atomic number (18) is ………………… element.

(Transitional - metallic - Inert - halogen)

Q (2): Complete :

1- Moseley put ………………… and ……………… series below the periodic table.
2- By increasing the atomic number the value of mass number will ………………
3- The modern periodic table consists of …………………… horizontal periods and ………………………… vertical groups.
4- The two scientists …………………… and …………………… made modifications in Mendeleev's table.
5- Mendeleev arranged the elements according to the ……………………… while Moseley arranged them according to the ……………………………… .

Q(3): Locate the position of the following elements in the modern periodic table:

H_1 Ne_{10} Ca_{20} P_{15} O_8 K_{19} Mg_{12}

Q(4): Find the atomic number of the following elements :

X ⟶ 1st period , 0 group.

Y ⟶ 2nd period , 3A group.

Z ⟶ 3rd period , 7A group.

V ⟶ 3rd period , 3A group.

Q ⟶ 2nd period , 1A group.

Lesson 2 : Graduation of the elements properties in the modern periodic table :

3 properties will be studied:

1- Atomic size property.
2- The electro-negativity property.
3- Metallic and non-metallic property.

❶ Atomic size property :

*The atomic size is evaluated (measured) by bicometer which is part of a million of a million of the meter.

In the same period:

The atomic size decreases with the increasing of atomic number due to the increasing in the attraction force between the positive nucleus and the negative electrons in the outermost energy level.

In the same group :

The atomic size increasing with atomic number increasing due to the additional energy level filled with more electrons.

❷ The electro-negativity property :

*The ability of the atom in the covalent molecule to attract the electrons of the chemical bond towards itself.

Polar compound	Non-polar compound
It's a covalent compound , the electro-negativity between its elements is relatively high.	It's a covalent compound , the electro-negativity between its elements is relatively low.
Ex: Water molecule H_2O O = 3.5 H = 2.1 The difference in the electro-negativity = 3.2 – 2.1 = 1.4 Ex: Ammonia molecule NH_3 N = 3 H = 2.1 The difference = 3 – 2.1 = 0.9	Ex: Methane gas molecule CH_4 C = 2.5 H = 2.1 The difference in electro-negativity = 2.5 – 2.1 = 0.4 Ex: Hydrogen sulphide H_2s S = 2.5 H = 2.1 The difference = 2.5 – 2.1 = 0.4

*The covalent bond is described as pure bond when the electronegativity difference between the two atoms equal zero, ex: Oxygen molecule O_2.

❸ The Metallic and non-metallic property :

Elements are classified into 4 kinds :

Metals | Non-metals | metalloids (semi-metals) | Inert gases

1) Metals :

- Elements with outermost shell contain less than 4 electrons.
- They tend to loss electrons in chemical bonds to form positive ions, to reach the nearest inert gas preceding them in the periodic table.
- Ex: Li_3 Na_{11} Ca_{20} Mg_{12}

2) Non-metals :

- Elements with outermost shell contain more than 4 electrons.
- They tend to gain electrons forming negative ions.
- Ex: C_6 O_8 P_{15} S_{16}

3) Metalloids (semi-metals) :

- They are elements which have both the properties of metals and non-metals
- Ex: B_5 Si_{14} As_{33}

4) Inert gases :

- Located in the (0) group
- They are inert gases hardly enter in any chemical reactions.

SO:

In periods:

Increasing in atomic number → decreasing in metallic property.
→ Increasing in non-metallic property.

*the group starts with strong metal then semi-metals appear then ends with strongest non-metal which are the elements of group (7A).

In groups :

Increasing in atomic number → Increasing in the metallic property
(due to the increasing in atomic size)
→ Decreasing in non-metallic property
(due to the deceasing in electronegativity)

*chemical properties of metals :

To understand the chemical properties of the metals , follow the steps :

1) ***Tools:***

- Magnesium strip
- Water
- A small piece of copper
- Thin wire of iron
- test tube
- diluted hydrochloric acid
- two jars filled with oxygen

2) ***Steps :***

a- Put a magnesium strip in a test tube and apiece of copper in another one , then add a diluted hydrochloric acid on both of them.

b- Heat a piece of magnesium strip and iron strip till glowing then put both of them each in one tube filled with oxygen , then add drops of water on both with shaking, then drops of litmus violet solution.

3) ***Observation :***

a- Magnesium react with the diluted acid forming a substance which dissolve in water with gas evolves , while copper doesn't react .

b- In magnesium state the violet litmus solution turns to blue color, while in iron tube a substance is formed which doesn't dissolve in water.

4) ***Conclusion :***

a- Some active metals such as Mg and Zn react with diluted acid forming the salt of the acid and hydrogen gas evolves.

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2\uparrow$$

b- Metals react with oxygen forming metallic oxides which known as basic oxides .

$$2Mg + O_2 \xrightarrow{\triangle} 2MgO \text{ (magnesium oxide)}$$

$$2Fe + O_2 \xrightarrow{\triangle} 2FeO \text{ (iron II oxide)}$$

c- Some of the metal oxides dissolve in water forming alkalis (metal hydroxide) which turns the litmus violet solution into blue , others do not dissolve in water.

$$MgO + H_2O \longrightarrow Mg(OH)2 \text{ (Magnesium hydroxide).}$$

Chemical activity series :

A series in which the metals are arranged descending according to their chemical activity.

Ex: Reaction with water

K , Na ⟶ react with water instantly with H_2 hydrogen gas evolves which burns with a pop sound.

Ca , Mg ⟶ React very slowly in cold water.

Zn , Fe ⟶ React at high temperature only.

Cu , Ag ⟶ Do not react with water.

***Real life application: (cleaning silver tools)**

- Cover a bowl with aluminum foil and put the silver tools on it , then cover it with hot water and add 3 spoons of baking powder on it.

- Leave the tools for 15 minutes with stirring.

- Dry the tools after rinsing them with hot water.

***Chemical properties of non-metals:**

a- Non-metals do not react with diluted acids (if you put a piece of carbon or sulfur in dil. HCl no reaction will happen)

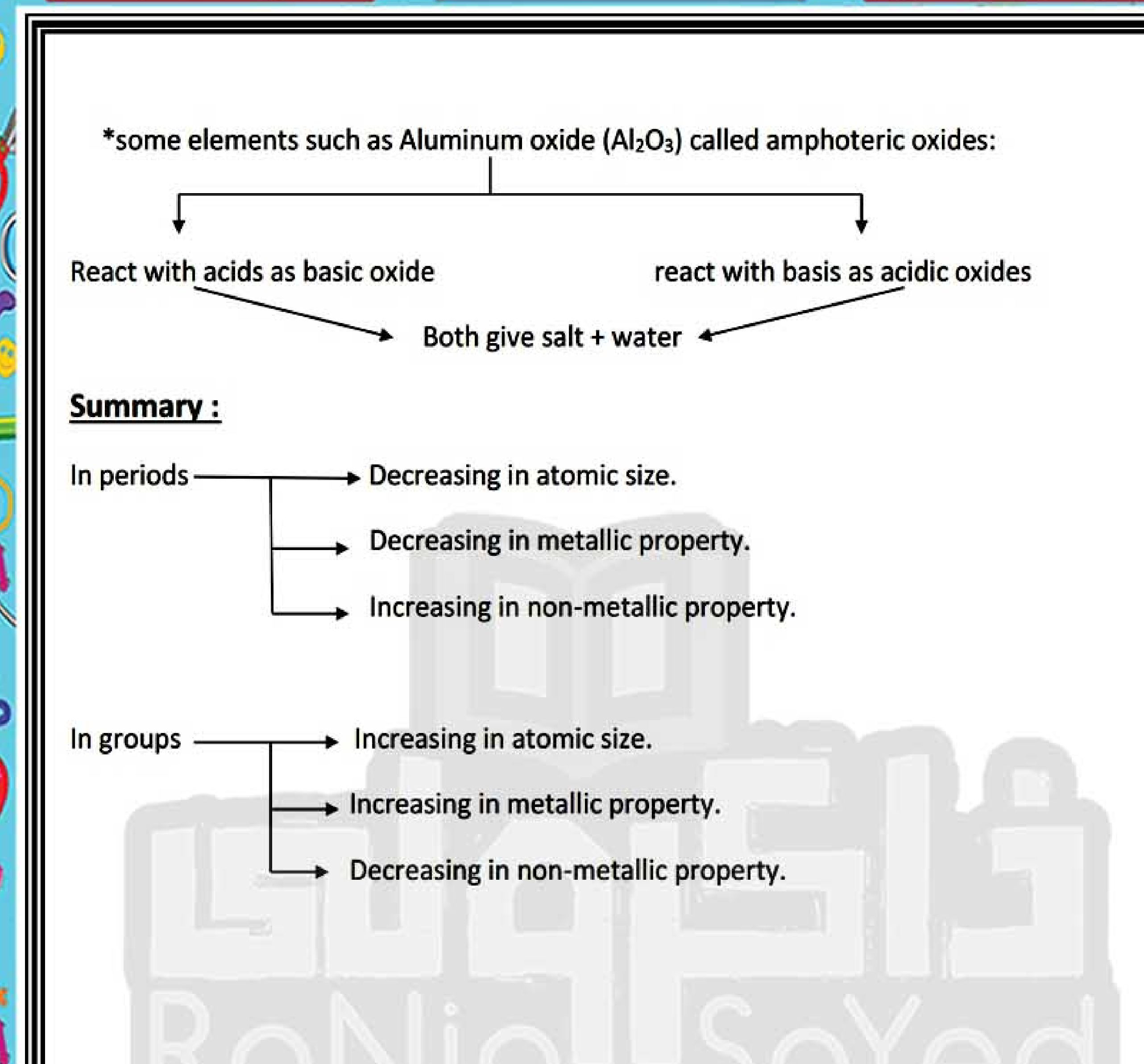
b-Non-metals react with oxygen forming acidic oxides:

$$C + O_2 \xrightarrow{\triangle} CO_2 \quad \text{(carbon dioxide)}$$

- Burn a piece of coal on a burning spoon and put it in a tube filled with oxygen then drops of water followed by drops of violet litmus solution. The litmus solution will turn to red.

c-Acidic oxides dissolve in water forming the acid which change the violet litmus solution into red.

$$CO_2 + H_2O \longrightarrow H_2CO_3 \quad \text{(carbonic acid)}$$


*some elements such as Aluminum oxide (Al_2O_3) called amphoteric oxides:
React with acids as basic oxide
react with basis as acidic oxides
Both give salt + water
Summary :
In periods
Decreasing in atomic size.
Decreasing in metallic property.
Increasing in non-metallic property.
In groups
Increasing in atomic size.
Increasing in metallic property.
Decreasing in non-metallic property.

Quiz②:

Q (1): Choose :

1- The 3[rd] period starts with elements their oxides are as following:
-Acidic , amphotric , basic
-Acidic , basic , amphotric
-Basic , acidic , amphotric
-Basic , amphotric , acidic

2- In the same period the elements which have the highest electro-negativity lies in group

(0 - 7A - 2A - 1A)

3-When sodium react with water .... gas evolves.

(O_2 - CO_2 - H_2 - N_2)

4-Metal oxides are .... Oxides.

(acidic – basic – amphotric – neutral)

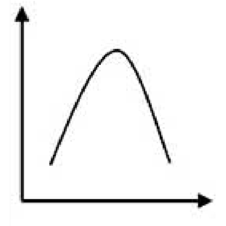
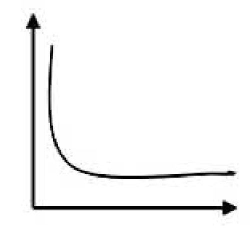
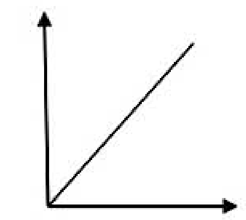
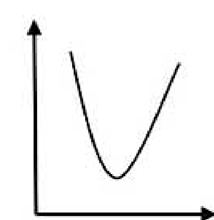
5-When magnesium oxide react with water .... is produced which turns the litmus solution into ....

($Mg(OH)_2$ - MgO - MgCl - HCl)

6-Zinc and iron react with water only in .... temperatures.

(low - high - medium - no correct answer)

7-Which of the following figures represent the graduation in electro-negativity in the second period

Q (2) : Complete :

1- The polar compound is a ………………… Compound, the electro-negativity difference between its elements is relatively ……………………………… .
2- The atomic size of Na element is ………………………… than the atomic size of P element (they are in the same period).
3- Each period in the modern periodic table starts with ……………………… element and ends with ……………………………… element.
4- By increasing the atomic number , the value of mass number will ……………………… in period of the periodic table.
5- The strongest non-metal elements are in the ……………………… Group.

Q (3) : Explain with chemical reaction (if found);

1- The behavior of iron, silver potassium in water.
………
2- Reaction between carbon (C) and hydrochloric acid HCl.
………
3- Reaction between (Mg) magnesium and HCl.
………
4- Reaction between (Mg) magnesium and oxygen (O_2).
………
5- Reaction between water (H_2O) and carbon dioxide (CO_2)
………

Q(4) : Write the scientific term :

1- The ability of the atom in the covalent molecule to attract the electrons towards itself. (………………………………………)
2- A kind of elements in which their valency shell contain less than 4 electrons. (……………………………………)
3- A kind of oxides that react as acidic or basic oxides according to the reaction conditions. (………………………………………)
4- A kind of elements which has more than 4 electrons in its outermost shell(…………………………………………)

5- Covalent compounds in which the difference between the electro-negativity of its elements is relatively low. (..)

Q (5): Give reasons for :

1- Fluoride is considered from the strongest non-metallic elements.

....

2- By increasing the atomic number of the elements their atomic weight decreases.

....

3- The increasing in the atomic size gradually in groups.

....

4- Aluminum oxide is considered as amphotric oxide.

....

5- Sulfur dioxide is considered as acidic oxide.

....

Lesson 3 : Main groups in the modern periodic table

Alkali metals (1A) | Halogens (7A)

❶ Alkali metals (1A) :

a- Situated in the maximum left of the table at the S-block elements.

b- They called so because they react with water forming alkali solutions

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

c- Although hydrogen gas is found in group (1A) , it is not metal , it is non-metal because of the small size of its atom and because it's a gas.

d- They are mono-valent elements because they have only one electron in their outermost shell.





e- They tend to lose their valency electron forming positive ions to be similar to the nearest inert gas.

f- They are chemically active elements so they are kept under kerosene or paraffin to prevent its reaction with moist air around them.

g- Their chemical activity increases with the increasing in atomic size , so (Cs) is considered the most active metal.

h- They are good conductor to heat and electricity.

i- Most of them have low density

Li , Na , K float in water surface

Rb , Cs sink under water surface

Reaction with water (to understand their chemical activity):

- put a small piece (pea-sized) of sodium in a water basin, and a piece of potassium in another water basin.

Ob.: both of them react with water with hydrogen gas evolves which burns with a pop sound. The reaction of potassium is stronger than sodium due to the bigger size of the atom.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$$

$$2K + 2H_2O \longrightarrow 2KOH + H_2\uparrow$$

❷ Halogens (7A) :

a- They are located in the right of the table at the P-block.

b- They are called so because they react with metals forming salts

K + Br KBr (potassium bromide)

c- They are mono-valent because they have one electron in their outermost shell .

d- They exist as di-atomic molecule F_2 , Cl_2 , Br_2.................. .

e- They are very active elements , so they do not found individually in nature but they exist in chemical compound, except astatine which prepared in labs.

f- Each element of the group replaces the element below it in their solutions.

Cl_2 + 2KBr 2KCl + Br_2

Br_2 + 2KI 2KBr + I_2



g- Their physical state is graduated from gaseous state (fluorine , chlorine) to the liquid state (Bromine) to the solid state (iodine).

***Uses of some elements:**

1. **Sodium** is used in liquid state as it is good conductor of heat. It is used in transferring heat from inside the nuclear reactor to outside to obtain the vapour energy required to generate electricity.
2. **Silicon** slides are used in computers manufacturing as it is semi-conductors, which their conductivity depends on the temperature.
3. **Liquified Nitrogen** used in preservation of the cornea of the eye because it has a low boiling point (-196^{0}C)
4. **The radioactive Cobalt 60** is used in food preservatives, because gamma rays come out from it prevent any microbial reproduction.
5. By the Egyptian scientist Moustafa El-Sayed do a great efforts science 2008 to use **Gold** in treatment of cancer.





Quiz ③:

Q (1): Choose :

1- .... Is used in food preservatives.
(chlorine – liquefied nitrogen – iodine – radioactive cobalt 60)

2- The reaction of .... with water is considered stronger than the reaction of Na sodium in water.
(Cl - K - C - Br)

3- The halogen elements belong to group.....................
(1A - 2A - 6A - 7A)

4- The strongest alkali earth's metals in reaction with water is ....
(Mg - Ca - Ba - Na)

5- .... is considered from halogens.
(Sodium – Chlorine – Helium – Calcium)

Q (2): Give reasons :

1- Elements of group (1A) is called alkali metals.
....

2- Silicon slides used in the manufacturing of computers.
....

3- Coal is used in getting rid of the odour of the refrigerator.
....

4- The chemical activity of the alkali earth's metals increases with the increasing in atomic size.
....

5- Liquefied nitrogen is used in the preservation of eye cornea.
....

6- Sodium and potassium are kept under kerosene or paraffin.
....

Q (3) : What is the symbol which represents :

1- The most active metal.
2- The most active non-metal.

Q (4) : Show by balanced equations :

1- The reaction between sodium (Na) and water(H_2O).

....

2- The reaction between chlorine (Cl) and potassium bromide (KBr).

....

3- The reaction between sodium (Na) and bromine (Br).

....

Lesson 4 : Water

*Water importance:

1- All living organisms animal, plants even microbes can't live without water.
2- It is an important mean of transportation between countries and even continents.
3- Many countries (including Egypt) depend on water to generate electricity.

*Water sources :

Rivers , seas , oceans ,wells and springs.

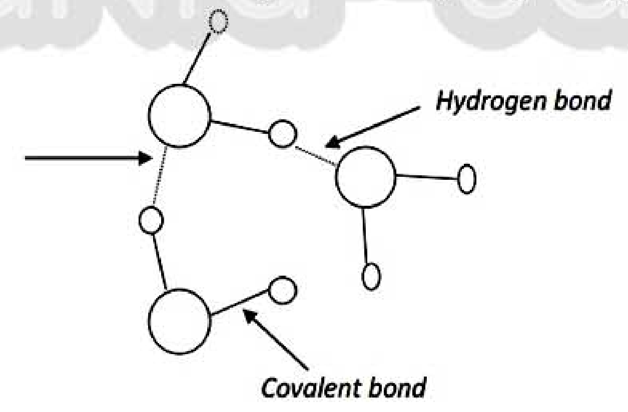
*Asia is the most continent using of water in agriculture field.

*Europe is the most using of water in industrial field.

*Southern USA is the most in the personal field.

*Water structure :

1- The water molecule is formed of the combination between one atom of oxygen and 2 atoms of hydrogen forming 2 single covalent bond the angle between them is 104.5^0
2- The hydrogen bond: is the weak electrostatic attraction that originates between water molecules due to the large electro-negativity of oxygen.



3- These hydrogen bond are weaker than the covalent bond but they are responsible for the abnormalities of the water properties.

***Water properties :**

1- Good polar solvent

2-Rising in its boiling point and melting point (abnormalities in physical properties)

3-It has low density when it freezes.

4-Rising of its latent heat.

5-Weakness of its ionization.

6-It has neutral effect on both litmus papers.

7-Its resistance to analysis.

Physical properties:

❶ Water is found in the 3 states of matter:

(Gas,Liquid,solid)

❷ Water is a good polar solvent:

It is a good polar solvent for most ionic compounds (Ex : table salt), and for some covalent compounds (Ex : sugar) which form hydrogen bond with water.

❸ Rising of its boiling and freezing point:

- According to the position of oxygen in the modern periodic table, water should boil at temperature less than 100^0C and freezes at temperature less than 0^0C………………… well that's not happening.
- The abnormality of the physical properties of water , is due to the hydrogen bonds in it.

❹ Water has low density when it freezes :

-When the temperature of water decreases than 4^0C , the water molecules are collected by hydrogen bonds forming hexagonal crystals with many spaces ,So, the density of water in the solid state is lower than its density in liquid state.

-Ice floats on the surface of water in the frozen zones which make the marine organisms survive.

-Density of salt water is higher than the density of fresh water so swimming in sea is easier than swimming in pools.

chemical properties:

❶ Neutral effect on both of litmus papers :

The pure water doesn't change the red or blue litmus paper which means that pure water has a neutral effect on both of them.

❷ Its resistance to analysis:

- At normal conditions , or by the effect of heat, water is not analyzed into two elements.
- This property help to keep water solutions in the cells of living organisms.

*Electrolysis of water :

- Tools :



1. A round piece of foam plate
2. Sodium carbonate
3. Empty plastic bottle
4. Two pencils
5. Battery 4.5 v
6. Two test tubes
7. Water
8. Two copper wires

-Connect the circuit as shown in the figure

-keep it close for 10 minutes.

-measure the volume of the gas evolved above the anode and cathode.

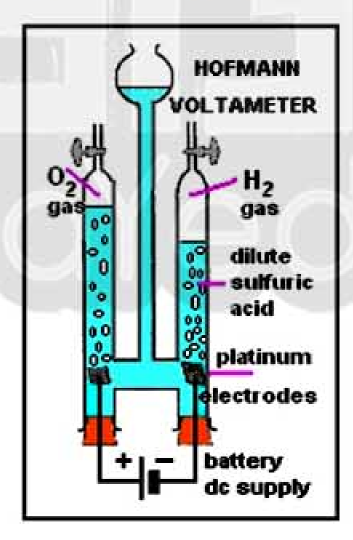
-Approach a glowing splint to both of the gases.

-Observation :

1. The volume of the evolved gas above the cathode is double the volume of the evolved gas above the anode.
2. The evolved gas above the anode makes a glowing splint more glowing, while the gas above the cathode burns with a blue flame with a pop sound.

-Conclusion:

1. The acidified water decomposed by electricity into hydrogen and oxygen and the volume of hydrogen is twice the volume of oxygen.
   $2H_2O \longrightarrow 2H_2\uparrow + O_2\uparrow$
2. Hydrogen evolves above the cathode, while oxygen evolves above the anode.
3. Hoffman voltmeter is used in electrolysis of water.



*Water pollution :

The continuous increasing in industrial and agricultural activities leads to water pollution.

*Water Pollution :

Addition of any substance to water that causes a gradual continuous change in its properties affecting the health of life of living organisms on which we depend.

*Water pollutants:

Environmental pollutants are divided generally to :

Natural pollutants:

Their source are natural phenomena Like volcanoes, thunder storms which causes the death of some living organisms.

Artificial pollutants:

Their source are the different human activities.

*Water pollution is divided into 4 main parts:

1. Biological pollution.
2. Chemical pollution.
3. Thermal pollution.
4. Radiant pollution.

❶ Biological pollution :

It is from mixing human and animal wastes in water (ex : animal stools in Nile) , that causes many diseases such as Bilharzia, Typhoid and Hepatitis.

❷ Chemical pollution :

-It is from discharging of factories wastes and sewage in canals, rivers and seas.

-Eating fish containing high ratio of lead causes brain cells death

-Drinking water which contain high ratio of mercury leads to blindness.

-Arsenic increases the rate of infection of liver cancer.

❸ Thermal pollution :

It is from the rise of temperature of some marine zones which use water for cooling their nuclear reactors which destroy the marine organisms due to separation of dissolved oxygen in water.

❹ Radiant pollution:

It is from leakage of radioactive substances from the nuclear reactors or dumping of the atomic wastes in seas and oceans.

***Protection of water from pollution:** (in Egypt)

1- Getting rid of the phenomenon of discharging of sewage, factories wastes and dead animals in rivers and seas.

2-Development of water purification stations and making a periodic analysis to determine the rate of its validity for drinking.

3-Spreading environmental awareness among people about protection of water from pollution.

4-Disinfecting drinking water tanks above buildings periodically.

5-Do not store the tap water in plastic bottles of mineral water because they react with chlorine gas which is used in disinfecting of water, so the rate of cancer infection increases.

Quiz ④ :

Q. (1): Give reasons:

1- Presence of hydrogen bonds between water molecules.
....
2- Pure water doesn't affect litmus papers.
....
3- Although sugar is a covalent compound, it dissolves in water.
....
4- Tap water should not be stored in plastic bottles of mineral water.
....
5- Water has a high boiling and freezing points.
....

Q. (2): What's meant by:

1- Water pollution.
....
2- The latent heat of fusion.
....
3- Ionization.
....

Q. (3): How do we keep water from pollution?

....
....
....
....
....
....
....

Q. (4): What is the effect of the following on the water environment:

1- Drainage of factories wastes in rivers and seas.

....

2- Using of rivers and seas water for cooling the nuclear reactors.

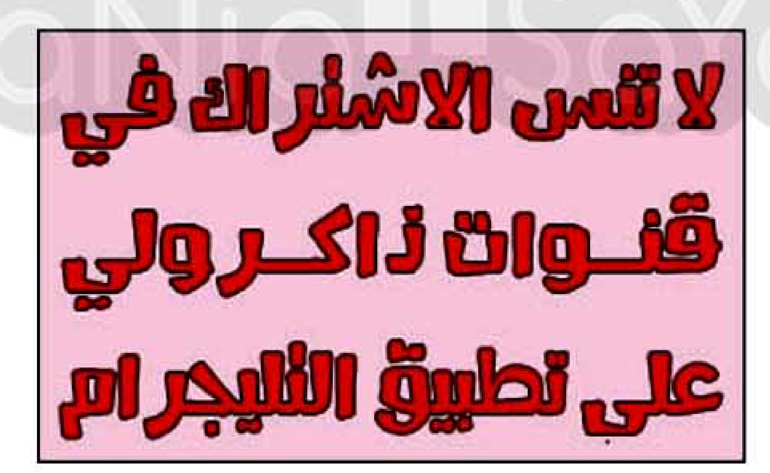
....

3- Mixing of animal and man wastes with water.

....

Q. (5): Choose from (B) what suits (A) column:

(A)	(B)
Probably harm	Responsible pollutant
1- Death of brain cells. 2- Cancer of liver. 3- Blindness.	1- Lead 2- Sodium 3- Mercury 4- Arsenic





Unit 2 : The atmosphere and protecting planet Earth

Lesson 1 : The atmospheric layers

<u>*The Atmosphere :</u>

A gas layer that surround the Earth and rotates with it about its axis , and extends 1000 Km above sea level.

*The atmospheric pressure (air pressure):

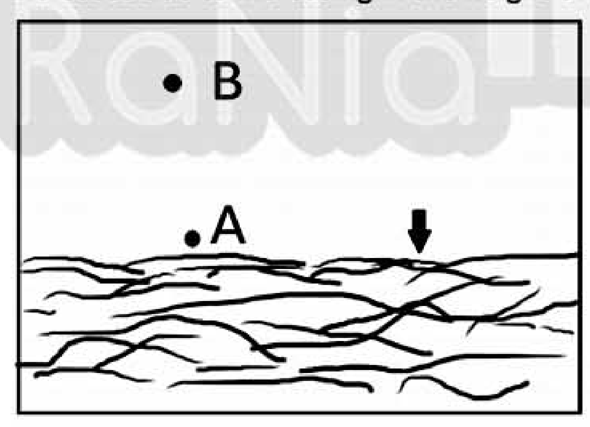
-The weight of air column of an atmospheric height on a unit area.

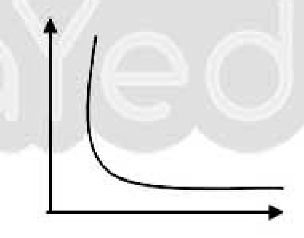
-It is measured by a bar which equals 1000 millibar (mbar).

-Normal atmospheric pressure at sea level 1013.25 mbar.

-The atmospheric pressure changes according to the change of height from sea level:

- As the elevation (height) above sea level decreases, the atmospheric pressure increases due to increasing in the height of air column.





- Which means that air pressure at point (A) is higher than the air pressure at (B) point.

*50% of atmospheric mass occurs in the area between sea level and 3 km high, 90% of this atmospheric mass concentrated in the first 16 km above sea level.

***Real life app.:**

- ***Altimeter :*** used in airplanes to determine the elevation of the navigation based on the atmospheric pressure at this level.
- ***Aneroid :*** a type of barometer which is used to determine today's atmospheric pressure.

****Atmospheric pressure maps:***

They are maps in which the points of the same pressure are connected together by curved lines called isobars.

In this maps ,the center of the lowest pressure area is represented by (L) and the center of the highest pressure area represented by (H).



➢ **Atmospheric Layers:**

Troposphere | Stratosphere | Mesosphere | Thermosphere

❶ Troposphere:

- The first layer of the atmosphere. It means the disturbed layer where most of the weather changes occur.
- Its thickness is 13 km to the tropopause (it extended 13km above sea level).
- The temperature decreases, as we go higher, by a rate 6.5 ^{0}C per 1 km until it reaches the lowest value at tropopause which is (-60^{0}C).
  The temperature at certain height = the temp. at sea level – the decrease in temp. (height in km x 6.5^{0}C)
- Atmospheric pressure decreases ,as we go above ,where it reaches 0.1 of the normal pressure at sea level (100 mb)

- It contains about 75% of the atmospheric mass, so all atmospheric phenomena like winds, rains ,clouds occur in it. These phenomena form the weather conditions of our planet.
- It contains 99% of the atmospheric water vapor, which organize the earth's temperature.
- The air movement in this layer is vertical. The warm air currents go up and the cold currents go down.

❷ Stratosphere :

- The second layer of the atmosphere, which is called the ozone atmosphere.
- It extends from the tropopause (13 km above sea level) to the stratopause (50km) with thickness 37km.
- At the lower part of the layer, the temperature is constant (-60^{0}C) and increases gradually until reaches 0^{0}C at the top of the layer. This rising in temperature because the ozone layer which is found in the upper part of this layer absorb the ultraviolet radiation that is emitted from the sun.
- The atmospheric pressure decreases as we go higher where it reaches the smallest value at the end of this layer (0.001 of the normal pressure at sea level)
- It contains most of atmospheric ozone which is concentrated between 20 – 40 km above sea level.
- The lower part of this layer is very suitable for flying planes where it doesn't contain clouds or any weather disturbance and the air moves horizontally.

❸ Mesosphere;

- The third atmospheric layer , which means the middle layer. It is the coldest layer.
- 35 km thickness ,from the stratopause (50 km) to the mesopause (85 km).
- Temperature decreases with height rate until reaches (-90 ^{0}C) at its end.
- It contain only a limited amount of hydrogen and helium gases, so it is much vacuumed.



- In this layer, meteors are burnt due to the friction with air molecules, while the spaceships do not burn as they have a conical front that disperses heat and its tails made of an insulated material.

4 Thermosphere:

- The forth atmospheric layer, which means the hottest layer of the atmosphere.
- 950 km thickness, from the mesopause (85 km) to 675 km above sea level.
- Temperature increases rapidly going higher until reaches 1200 ^{0}C.
- ***Ionosphere :***
    1) It is a layer at the upper part of the thermosphere which contains charged ions and extends 700 km above sea level.
    2) Ionosphere has an important role in wireless communication and broadcasting as it reflects radio waves that are transmitted from communication centers and radio stations.
    3) Ionosphere is surrounded by two magnetic belts called ***Van Allen Belts*** which play an important role in dispersing the harmful charged cosmic radiation away from the Earth. These two belts cause ***Aurora phenomenon*** which appears as brightly colored light curtains at both north and south poles of the Earth.

*Exosphere:

The atmosphere is inserted into the outer space through the exosphere where satellites float around the Earth which transmits weather condition information and TV programs.



Quiz ⑤

Q. (1): Mention the importance of the following device:

1. Van Allen Belts.

....

2. Altimeter.

....

3. Satellites.

....

Q. (2): What's meant by:

1. Atmospheric pressure.

....

2. The Aurora phenomenon.

....

3. Exosphere.

....

Q. (3): Give reasons:

1. The lower part of the stratosphere is suitable for plane flying.

....

2. The upper part of thermosphere is called ionosphere.

....

3. Rains, clouds and winds are in troposphere.

....

4. The upper part of stratosphere has relative high temperature than the lower part.

....

Q. (4): choose:

1. Normal atmospheric pressure equals ………………………… millibar.

   (1013.25 - 76 - 1.013 - 760)

2. ………………………… Is located between stratosphere and mesosphere.

   (stratopause – tropopause – mesopause – thermosphere)

3. Meteors burn in …………………………… .

   (mesosphere – ionosphere – exosphere – stratosphere)

4. The hottest atmospheric layer is …………………………… .

   (troposphere – stratosphere – mesosphere – thermosphere)

5. The coldest atmospheric layer is ……………………………… .

   (troposphere – stratosphere – mesosphere – thermosphere)

6. The device used in measuring the atmospheric pressure is …………………… .

   (altimeter – aneroid – barometer – a and b)

7. The device used in measuring the altitude from the Earth's surface is

   ……………………… .

   (altimeter – aneroid – barometer – a and b)

8. The charged cosmic radiation are dispersed in the ………………… layer.

   (troposphere – stratosphere – mesosphere – thermosphere)

Lesson 2 : Erosion of Ozone layer and global warming

First : Erosion of Ozone

- Ozone layer is located in the stratosphere at a height of 20 – 40 km above sea level.
- Ozone layer is found in this location because of the suitable amount of oxygen gas and it is the first layer that meets the ultraviolet radiation coming from the sun.

*Structure of Ozone gas and how it formed:

Ozone gas is formed in 2 steps:

1. The oxygen molecule O_2 absorb the Ultraviolet radiation causing the breaking down of the bond in this molecule, producing two free active oxygen atoms 2O.

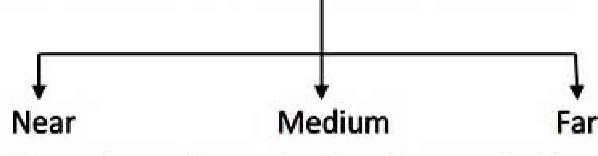
$$O_2 \xrightarrow{UV} O + O$$

2.Each free oxygen atom combines with an oxygen molecule to produce an ozone molecule O_3.

$$O + O_2 \longrightarrow O_3$$

*Importance of Ozone layer:

- Ultraviolet radiation is divided into 3 types :



- Ozone layer does not allow the penetration of all far and medium ultraviolet radiation which have very harmful effects on all living organisms.
- That's why they called ozone layer the protective shield for living organisms against harmful chemical effects of ultraviolet radiation.



- UV radiation of wavelength close to the visible light penetrate the atmosphere and reaches the Earth's surface, where it helps in producing vitamin D in the bodies of new born babies.

***Erosion of ozone layer:**

- A scientist called Dobson postulated that the thickness of ozone layer is 3mm only if it were under the normal pressure and 0 0C temperature; in a condition called STP (standard temperature and pressure). According to what he assumed the amount of ozone equals 300 Dobson units.
- Science 1978, scientists noticed that there was an erosion of the ozone layer above the South Pole, which is called ***the Ozone hole***.

***Pollutants of ozone layer:**

1. ***Chlorofluorocarbon compounds CFCs:***
   They are commercially called Freon which is used as:
   - Cooling substance in air conditioning sets
   - Propellant substance in aerosols.
   - Floating substance in making foam backing.
   - Solvents substance for cleaning electric circuits slides.
2. ***Methyl bromide gas*** which is used as insecticide to preserve the stored agricultural crops.
3. ***Halons*** which is used in fire extinguishing.
4. ***Nitrogen oxygen*** which is produced from the burning of fuel of ultrasound airplanes (Concord).

So, erosion of ozone layer continues because of the pollutants.

Second : Global Warming

It is the increasing in the average temperature of the Earth's near-surface air.

*Researches of IPCC (The Intergovernmental Panel on Climate Change) showed the increasing in Global Warming phenomenon due to the effect of the greenhouse.

*Greenhouse effect:

- The temperature of the planet increases since 1935 due to the increasing in greenhouse gases in the atmosphere. The most important gases are:

1. Carbon dioxide gas CO_2 (its ratio increases from 0.031% to 0.0385 in 2005). CO2 increases in the air due to the fossil fuel burning, cutting trees and forest fires.
2. Chlorofluorocarbon CFCs compounds.
3. Methane gas CH_4.
4. Nitrous oxide N_2O.
5. Water vapor H_2O.

*interpretation of the greenhouse phenomenon:

When the concentration of greenhouse gases increases in the atmosphere, it plays the role of the glass in the greenhouse as:

1. It permits the visible light and short waved radiation from the sun to pass through.
2. The Earth and its components absorb those radiations and re-emit the radiation back in the form of infrared radiation.
3. Infrared radiation can't penetrate the atmosphere as it has a long wavelength.
4. Infrared radiation kept trapped in the troposphere causing the rising of temperature of our planet.

***The negative effects of Global Warming phenomenon:**

❶ ***Melting of the ice and snow of both south and north poles:***

It will cause the increasing in sea level in seas and oceans which will :

- Disappearance of coastal areas .
- Extinction of polar animals like polar bear and seals.

❷ ***Severe climate changes:***

The repeated occurrence of tropical hurricanes such as hurricane Katrina in 2005, destroying floods ,drought waves and forest fires.

- These destructive effects made 160 nations singed the Kyoto Protocol in Kyoto Japan in 1997 , which suggested reducing the ratio of bad emission by cutting down the consumption of fossil fuel and searching for environmental friendly alternatives energy resources.



Quiz ⑥ :

Q. (1): Give reasons:

1. The increasing in the ratio of CO_2 in the atmosphere.

   ………

2. Stop producing the Concord airplanes.

   ………

3. Formation of ozone layer in stratosphere.

   ………

4. The trading of producing CFCs compounds is prohibited.

   ………

5. The ozone layer is considered as the protective shield for all living organisms.

   ………

Q. (2):choose :

1. Ozone layer is measured by a unit called ……………………………… .
   (Km - Dobson - nm - mm^3)
2. All are greenhouse gases except ……………………………… .
   (CO_2 - O_2 - N_2O - CH_4)
3. The ozone molecule is consist of ………………………… .
   (4 oxygen atoms – 2 oxygen atoms – 3 o atoms – 1 oxygen atoms)
4. The CFCs compounds break down under the effect of ultraviolet rays to release ………………………… atom.
   (carbon - chloride - oxygen - Freon)
5. The ozone layer doesn't allow the passage of ……………………………… ultraviolet rays.
   (far - medium - near - a&b together)
6. …………………… Is used as a coolant in cooling devices.
   (Methyl bromide gas – Halons – Nitrogen oxide – Freon)
7. …………………… is used as insecticide to preserve stored agricultural crops.
   (Methyl bromide gas – Halons – Nitrogen oxide – Freon)

Q (3) : Mention 2 harmful effects that are caused by Global Warming

Q. (4): Put (✓) or (X) :

1. 50% of the mass of the atmospheric envelope is in some area in between sea level and a 3 km elevation ( )
2. The satellites revolve around the Earth in a region called exosphere ( )
3. The air moves horizontally in the bottom part of stratosphere ( )
4. The thickness of mesosphere is 60 km ( )
5. The ionosphere is surrounded by Van Allen's belt which is responsible for scattering the harmful cosmic rays away from Earth ( )
6. Lacking of plants on Earth will lead to increasing in temperature ( )

Q. (5): Write the scientific terms:

1. A phenomenon looks like a colorful light curtains seen in the two poles (..)
2. The atmospheric layer that contain a certain amount of helium and hydrogen gas (..)
3. The gas resulting from the reaction between chlorine atom with ozone molecule (..)
4. A phenomenon that increases the percentage of CO2 and leads to increasing in the Earth's temperature (..)
5. A region between mesosphere and thermosphere (..)

Unit 3 : Fossils and Protecting Species From Extinction

Lesson 1 : Fossils

***Fossils:**

Trace and remains of the old living organisms that are preserved in sedimentary rocks.

Trace : indicate the living organism activity

Remains : indicate the living organism body or shape

***To have a good fossil 3 things should be happened:**

1. The organism should has a hard skeleton.
2. It must be buried fast after its death.
3. A suitable medium to protect it from decomposition.

***types of fossils:**

- Fossil of Complete body
- Mold
- Cast
- Petrified fossil

1 Fossil of complete body:

- When the organism died and was buried fast in a medium that preserved it from decomposition as in the case of snow or amber.
- It keeps the whole body shape and details.
- Examples:

1- Mammoth fossil:

- An mammoth animal died and rapidly buried under snow by a snow avalanche in Siberia 25000 years ago.



- The first mammoth fossil discovered was complete as the whole shape , all hairs, flesh and food in its bowels.

2- Amber fossil:

- Amber: It is a solidified resinous matter that was secreted by pine trees which was common in old geological periods.
- These resinous matter covered the insect and when it solidified it was changed into amber and preserve the body of the insect from decaying.

2 Mold:

formation of a mold:

1- When a snail (or clam), it falls on the sea floor and is buried in sediments.
2- The sediments fill up the shell cavities and solidified as the time passes.
3- The shell decomposes completely, leaving a rock mold carrying the internal details of the snails.
4- Ex.: Ammonite fossil mold, fossil mold of Trilobite.

****Real life app.:*** Candle mold

- Melt a paraffin wax
- Roll a piece of strong paper into a cylinder, put it in an empty yogurt can then pass a thick thread through it.
- Pour the melted wax in the cylinder, keeping the thread in it.
- After solidification, remove the paper.

3 Cast:

- The replica of the original external shape or outer shell of a living organism.
- What the dead body left on the sediments is called cast.
- what a living organism body left during its life is called a trace.
- Ex. of cast: fossil cast of ferns.
- Ex. Of trace: fossil trace of worm tunnels.

❹ Petrified fossils:

- it is a fossil where the minerals can replace the organic matter of organism part by part without changing the shape
- Ex: Petrified wood, Dinosaur's eggs , dinosaur's tooth.
- Petrification: formation of petrified wood by replacing the original wood material by silica part by part.
- Petrified wood looks like rocks but they are fossils because they give us details about once living old plant.

*Importance of Fossils:

1. Age determination of sedimentary rocks:

- ***Index fossils***: they are fossils of the organism that lived a short period of time in the past and become extinct.
- The index fossils indicate the age of sedimentary rocks they buried in, because both the sedimentary rock and the fossil are in the same age.

2. Figuring out the Paleo-enviroment:

- Fossils give an idea about the environment they lived in at the old geological ages.
- Fossils also indicate the climate of these ages. Ex.:

1) Nummulites fossils:

-They are found in the limestone of Gebel Mokattam.

-They indicate that there was a sea in this area more than 35 million years ago.

2) Ferns fossils:

-they indicate that they lived in a rainy tropical environment.

3) Coral fossils:

- They indicate that the environment where they lived in was clear, warm and shallow seas.



3. Studying the life evolution:

- Studying the fossils record showed that the life started in the sea, then established on land.
- Organisms always evolved from simple to complicated higher forms.
- Algae preceded mosses and ferns.
- Angiosperms appeared before gymnosperms.
- Invertebrates such as corals and mollusks with shell appeared before vertebrates. The first vertebrate appeared was fishes then amphibians then reptiles and finally birds and mammals appeared together.
- Archaeopteryx fossil is a link between reptiles and birds.

4.Petroleum exploration:

Geologists take sample from the rocks they searching for petroleum in.

They study these samples microscopically, if it contains microfossils, like foraminifera and radiolarian, this will indicate the age of the rock and if it is suitable for petroleum formation.



Quiz ⑦

Q. (1): Arrange the following fossils according to their appearance on the life stage:

1. Mold fossil of fish.
2. Mammoth fossil.
3. Trilobite fossil.
4. Archaeopteryx.

Q. (2): What's the difference between:

1. Trace and mold.

Trace	Mold

2. Cast and mold.

Cast	Mold

Q. (3): Complete:

1. Archaeopteryx represent the link between ……………………………. and…………………………. .
2. Fossils are used in …………………… Exploration and determining the age of …………………………. .
3. Complete fossils of insects are found preserved in……………………………. .
4. …………………… is an example of microfossils.
5. The suitable medium to form a mammoth fossil is ……………………………. .
6. The fossil is a trace and remaining of living organisms ………………………. Preserved in ………………………………. .

7. By studying the fossil record it shows that .... started first in .... then established on............................. .

Q. (4): Give reasons:

1. The petrified wood is considered from fossil in spite of their resemblance to rock.

   ....

2. Gebel Mokattam was once a sea floor more than 35 million years ago.

   ....

3. The amber is considered as suitable medium to form a complete body fossil.

   ....

Q. (5): Choose :

1. To have a fossil of any organism, it should have.........................
- A hard skeleton
- A medium to protect it from decomposition
- Fast burial after death
- All the above
2. On the solidification of resinous matter secreted by the pine trees in the old geological periods it forms.........................
- Petrified wood
- Amber fossil
- Trilobite fossil
- Nummulites fossil
3. Not all the fossils are considered index fossils and that's because they are characterized by ....
- Long range of time and limited geographical range.
- Short range of time and wide geographical range.
- Long range of time and wide geographical range.
- Short range of time and limited geographical range.

4. Which of the following fossils indicates that the environment they were formed in was a hot and rainy tropical environment
- Nummulites - Ferns
- Coral - Archaeopteryx
5. What's the kind of fossils formed when a plant leaf falls on a sedimentary rock in the beginning of it formation then it solidified.
- Trace - Cast
- Mold - Petrified wood



Lesson 2: Extinction

***Extinction:**

The continuous decrease without compensation in the number of a certain species of living organisms until all members dies out.

Ex.: The wild ram called Arwa ram in Egypt is threaded to be extinct.

***Factors causing extinction of species:**

Scientists postulated many theories to explain the great extinction phenomenon (Mass extinction) such as:

- Meteorites that impact with Earth.
- The onset of the long glacial age.
- Poisonous gases emitted by active volcanoes.

Recent extinction that is occurring now is due to different factors, most of them are due to humane interference in nature such as:

1. ***Destroying nature habitat:***
   - Tropical forests include about one third of the terrestrial living organisms, each tree form a shelter of more than 300 species of living organisms.
   - Removing forest destroys the habitat of these species and drive them stray and homeless.
   - We lose 68 species of trees every day.
   - Half the world's trees has become extinct since 1950, scientists expect losing a tree out of five in 2020.
2. ***Overhunting:***
   - Hundreds of reptiles and mammals species recently become extinct due to the absence of laws that control the wild animal hunting.
   - The development of the hunting weapons and the increasing interest of animals skin and furs increases the rate of hunting.

3. ***Environmental pollution:***

Since the industrial revolution in 1750 , pollution has propagated in all ecosystem. Among those pollutions:

- Acid rains fall and destroy forest trees.
- Chemical insecticides that break down the food chain.
- Oil leaks in seas and oceans.

4. ***Climatic changes and natural disasters:***

Natural disasters such as:

- Active volcanoes
- High marine tide (tsunami)
- Drought
- Floods
- Hurricanes

*The extinct and endangered species

First : Extinct species:

- Since the life establishment, it witnessed 5 mass extinctions. In each of them most species extinct followed by the appearance of another more evolved types.
- Some scientists say that we live the 6th mass extinction now, as the rate of extinction is 40 times over the normal extinction rate.
- One report said that the living organisms now are 10 million species , 138 species of them extinct every day.

*Examples of some extinct animals:

1. ***Dodo bird: (stupid bird)***
   - Bird with short leg and small-sized wing, so it's non-flying bird and can not run quickly. It is one meter long and build their nest on the ground.
   - These features make it easy for hunter to catch it, so it became extinct in 1681 in the Indian island after 50 years from man inavasion.

2. ***Quagga:***

It is a mammal, midway between horse and zebra. The last member of its species was killed in south Africa by hunters in 1883.

Second : The endangered species:

- IUCN, the International Union for Conservation of Nature, was established in 1963 to protect the endangered species.
- It issues every year a Red List , which is a list of endangered species and its level of danger.
- The endangered levels are classified into 3 levels:
  Critically Endangered (CR)
  Endangered (EN)
  Vulnerable (VU0
- They are 5000 species.

***Examples of endangered species:**

in 2008 the Red List includes 450 species included:

1. ***Panda bear:*** feed on bamboo plants
2. ***Rhinoceros:***
   - It is endangered because its habitat started to transformed into a cultivated lands.
3. ***Bald eagle:***
   - Its head is covered with white feathers, so it looks bald.
   - It is endangered because it feeds on fish that contain poisonous matter that is dumped in lakes and rivers.
4. ***Ibis bird:***
   - Disappeared from Aswan after the building of High Dam, due to loss of its nests.
   - This bird is still found in Upstream Nile in Africa.
   - It must be imported back to reproduce its species in the protectorates established in the Nile islands of Aswan.

- This bird was important for Pharaohs so you can see its picture in the walls of their temples, as they drank the only water from which this bird drank as it used to avoid polluted water.

5. ***Papyrus plant:***
- Grows in swamps of the Upper Nile.
- Pharaohs used it to make writing papers.
- It disappeared due to the drought of these swamps.
- It is now reproduce in Pharaonic Village in Giza (Hassan Ragab Village).

- There are also the double-dumped camel, snow tiger, blue whale, antelope deer and orangutans. They are endangered species.

*Effect of extinction on the geological equilibrium:

- Each living organism plays a role in transferring the energy throughout the food chain.
- When one organism disappears, its role stops, affecting the rest organisms in the food chain.

Extinction of one or more species in a balanced ecosystem caused a cavity in the ecosystem that would disturb the ecosystem or may destroy it.

➢ The ecosystem is classified according to the degree of effect of extinction on it into:

	Simple ecosystem	Complicated ecosystem
Members	Few members	Multiple members
Effect	Severely affected by the absence of one specie because of the rarity of alternatives that compensates this absence.	It is not affected much by the absence of a specie because it has many alternatives.
Ex.	The Desert ecosystem.	The Tropical ecosystem.

***Ways to protect living organisms from extinction:**

1. Issuing rules that control the hunting in land, seas, and air specially for the rare types.
2. Increasing the awareness about the importance of the natural life to sustain the existence of mankind.
3. Reproducing the endangered species and sending them back to their native habitat.
4. Establishing gene banks for those much endangered.
5. Establishing natural protectorates areas.

Natural protectorates:

- Safe area established to protect the endangered species in their homeland.
- The most recognized protectorates are:
  1. ***Bluestone in USA:*** it protects the grey bear.
  2. ***Panda protectorate:*** in northeast China.
  3. ***Ras Mohamed protectorate:***
     - in Egypt, which contain 134 types of rare coral reefs and also contains colored fishes.
     - It is the first one in Egypt which established in 1983.
  4. ***Wadi Hetan:***
     - It is part of Wadi El-Raiyan protractorate in Fayoum.
     - It contain about 205 complete whale skeleton fossils, from 406 whale skeleton fossils.
     - In 2005, the UNESCO declared Wadi Hetan as the best world heritage of whale skeletons.




Quiz ⑧

Q. (1): Mention the most important factors that cause species extinction now.

Q. (2): Give reasons:

1. The desert ecosystem is affected severely by the absence of on specie.
   ....
2. The dodo bird is an easy target to hunt.
   ....
3. The UNESCO chooses Wadi Hetan as the best world heritage region.
   ....

Q. (3): What's happen when:

1. The continuous evolution of manufacturing hunting weapons.
   ....
2. The falling of acidic rains on the trees of forests.
   ....

Q. (4): Mention one example of:

1. Endangered bird.
2. Endangered plant.
3. Animal habitats bamboo forest.
4. Bird habitats in North America.
5. Extinct bird.
6. Extinct animal.